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Eurycea bislineata wilderae Dunn

By JOHN THORNTON WOOD

Little has been published on the total lengths and tail lengths as a proportion of total lengths in completely transformed *Eurycea bislineata wilderae*. Minimum total length of 36 mm. was cited by Dunn, while King reported the largest specimen, whose total length was 120 mm. Bishop published the only averages, based on 17 males and 8 females, but his specimens did not represent the entire size range. His smallest male measured 80 mm., smallest female 71 mm. No data was provided on the specimens between 36 and 71 mm.

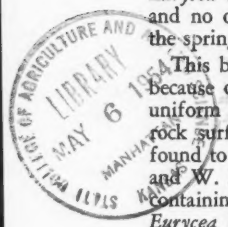
The conclusions in this report are based on a series of 28 specimens collected from Indian Gap, Tenn. and Wayah Bald, Hyatt Ridge, and Mt. Mitchell, North Carolina localities. Total lengths ranged from 45 mm. to 104 mm., and sex determinations were verified by dissection. These specimens were insufficient for statistical analysis, but by plotting tail lengths against total lengths two things became evident. First, there is no difference between the sexes in total lengths attained, and second, there is no sexual dimorphism in tail lengths as a proportion of total lengths. Tail lengths comprised greater percentages of total lengths in larger specimens. Tail/total proportions ranged from 45 to 60 percent in this series of specimens, but in any group of specimens of one total length considerable variation was observed in this proportion.

Ova were examined in 7 gravid females collected between April 4th and May 30th. All specimens came from elevations near 5,000 feet, and all ova were uniformly small (diameters between 0.75 and 1.0 mm.) Late summer egg deposition is indicated for the species at this elevation. Egg laying occurs earlier in the year at lower elevations.

An egg batch was found on Mt. Mitchell, No. Car., at 4,000 feet on May 4th. Embryos were not yet differentiated within these eggs. Dunn found larva emerging from an egg batch at Linville, No. Car. on July 19th. These localities are thirty miles apart, but the period between deposition and larval emergence, 75 days, has little significance in a species with wide altitudinal range. King collected *Eurycea bislineata wilderae* from 6,642, to 1,700 feet, over an altitudinal range of almost 5,000 feet!

The egg batch studied by the author was composed of 87 eggs each of approximately 2.5 mm. diameter. These eggs were individually suspended from the lower surface of a flat stone in a small seepage spring.

The run-off amounted to little, the trickle disappearing into talus substratum 50 feet from the spring. The habitat was isolated from other suitable areas, being located on an open rock escarpment. One female *Eurycea bislineata wilderae* was found roughly coiled beneath the eggs, and no other specimens of this species were seen. Other inhabitants of the spring included four *Desmognathus ochrophaeus carolinensis*.



This batch of 87 eggs is probably the complement of a single female because of the isolation of the habitat, absence of others of the species, uniform development of the eggs, compact grouping of the eggs on the rock surface, and the ovaries of gravid *Eurycea b. bislineata* have been found to contain more than 87 large ova in some individuals. The author and W. E. Duellman examined specimens of the closely-related *E. b. b.* containing up to 95 large ova. Bishop rejected a batch of 63 eggs of *Eurycea b. bislineata* from his averages for the species, as "altogether likely—that it represents the complements of more than one female," on the basis of its containing too many eggs to have been the deposit of a single female.

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VIRGINIA FISHERIES LABORATORY, YORKTOWN, VIRGINIA

Unusual Concentration of Garter Snakes.—On April 19, 1949, at about 3:00 p.m., I noticed an old iron cooking pot upside down, about eight inches high and twelve inches wide, lying twenty feet from the freshwater lagoon at Drakes Bay, California, that has been made a Marin County park. To my great surprise it covered some dozen garter snakes about fifteen inches long, of the thickness of my little finger, and with a longitudinal stripe. Immediately they slithered off into the surrounding grass and bulrushes which surround the lagoon.

It was too late in the year for hibernation. Perhaps they found it a refuge from the cold northwest wind which was blowing at the time. Perhaps the sun shining on the pot made its interior a place of warmth on this blustery day. I have noticed individual snakes near the water, and in the surrounding grasses, on numerous occasions, but never have I seen such a concentration.—AUBREY NEASHAM, *Regional Historian,* National Park Service.

The Identity of *Coluber subcarinata* Gray[1]

By HOBART M. SMITH

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In 1839 John Edward Gray described, and figured with a colored plate, a snake from "the hedges of Xalisco," Mexico. He named it *Coluber (Natrix) subcarinata*. Although the book in which the name appeared has been well known by taxonomists, the name *subcarinata* has completely escaped notice. Most surprising is its omission from Boulenger's Catalog of Snakes in the British Museum.

The original description follows (Zool. Beecheys Voyage: 96, pl. 32 col.).

"COLUBER (NATRIX) SUBCARINATA. t. 32.

"Above olive brown; sides obscurely brown spotted, beneath yellow; with a black-edged pale dorsal band, two half-scales wide. The body fusiform; the head rather depressed, with one rostral scale, triangular notched below. Nasal scales triangular, with nostrils pierced in their centre; with two triangular internasal plates, and two rather large fronto-nasal plates; two* frontal and one* nearly equal-sided superciliary scale on each side of it, and two larger parietal plates; one anterior and three posterior orbital scales on each side, with a very small triangular scale between the anterior one and the nasal plate. Mouth very large, gape reaching beyond the eyes. Upper lips with eight, and lower with ten labial scales on each side; the first lower lateral scales on each side very long. Mental plates, two pairs, the hinder largest, with three or four cross series of gular scales before the gular plates. The dorsal scales lanceolate, keeled, in about seventeen longitudinal series; the two central series strongly keeled, with the keels diminishing in distinctness, and the scales increasing in width toward the sides, so that the scales of the series next the abdominal plates are hexagonal, as broad as long, nearly twice as broad as the vertebral scales, and almost smooth. The ventral plates about one hundred and forty, wide, regularly arched, and yellowish. Tail conical, tapering slender, about one fourth of the length of the body, with eight or nine series of strongly-keeled, hexagonal scales above, and with about seventy pairs of subcaudal plates. Length of the body, two feet; of the tail, seven inches.

"Inhab. common in the hedges of Xalisco, a province of Mexico.—Tradescant Lay, Esq.; the specimen in the Museum of the College of Surgeons.

The plate accompanying the description shows a pale yellowish snake, with a dark brown band about 1 and 2/half scale rows wide on either side of a median light stripe 1 and 2/half scale rows wide; the dark band is very sharp-edged medially but merges more gradually with the yellow color laterally; the stripes all disappear on nape about 8 scales back of the parietal; they also are absent on the tail. The scale rows visible are

*The "one" (superciliary) and "two" (frontal) are obviously transposed.

19 in number, and since the curvature of the body conceals at least a few scale rows, the assumption is justified that at least 21 and perhaps 23 rows actually were present.

The snake obviously belongs to the genus *Thamnophis* of present nomenclature. Identification to species is less obvious but can be obtained with virtual certainty.

The inaccuracy of the scale row count indicates that little stress should be placed upon the ventral or subcaudal count. The pattern, shape of body, and indicated dorsal scale row count, however, completely eliminate from consideration all recognized Mexican species except *Thamnophis macrostemma* Kennicott (Proc. Acad. Nat. Sci. Phila., 12:331, 1860). The broad vertebral stripe eliminates *T. eques eques* and *T. melanogaster* from consideration, and the unspotted pattern and single preocular do not occur in *T. scalaris*. These are the only species of garter snakes known from Jalisco. Other Mexican species can be eliminated on similar grounds. On the other hand, no feature of the plate and no character cited in the description is clearly contrary to those occurring in *T. macrostemma*. The usual median dorsal scale row count of that species, 21, is the most probable count for the type of *subcarinata*. The ventrals cited for the type, "about" 140, are too few for *macrostemma*, which has between 149 and 171, but the count on the type of *subcarinata* was manifestly inaccurate; the assumption that the ventrals may have been 15 or 20 more than estimated is not unjustified. The estimate of the number of subcaudals in the type closely approaches the mean for the species. The pattern is rather peculiar and anomalous for the genus, but the variants occurring in this, the most variable Mexican species of the genus, are numerous. Variants similar to this are known to occur in other, normally spotted, species of the genus (e.g. *T. sumichrasti cerebrosus*).

Given a conspecificity of *Coluber subcarinata* and *Thamnophis macrostemma*, geographical probabilities are sufficient to strongly indicate common identity with the typical subspecies, *m. macrostemma*, inasmuch as that is the only form known to occur in Jalisco. Inasmuch as most early travelers in Jalisco visited Guadalajara, and since specimens are available from that locality, I hereby restrict the type locality of *Coluber (Natrix) subcarinata* Gray to Guadalajara, Jalisco.

No other trivial name *subcarinata* is now recognized in any of the genera *Coluber, Natrix* and *Thamnophis*, nor has that name been proposed in any of those genera in the past (except the present instance). Accordingly, allocation of *Coluber subcarinata* Gray 1839 with the species heretofore known as *T. macrostemma* Kennicott 1860 requires, unfortunately, suppression of the latter name as a junior synonym. The species to which both names apply should be known, therefore, as *Thamnophis subcarinata* (Gray, 1839). The two races generally recognized are *Thamnophis subcarinata subcarinata* (Gray 1839) and *Thamnophis subcarinata megalops* (Kennicott 1860).

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[1]Contribution from the University of Illinois Museum of Natural History, Urbana.

Gerrhonotus liocephalus infernalis Baird in Texas

By ALVIN FLURY

From October, 1947 to July, 1948 seven adult and two juvenile *Gerrhonotus liocephalus infernalis* Baird were kept alive in the laboratory. Our main object was to obtain eggs and young but other life history factors were noted because so little is known of the species. Twenty-two specimens have been inspected, all from Travis County except one each from Hays and Bexar Counties and two from Bandera County. The species is apparently of Mexican origin but this subspecies extends into Texas from Del Rio east to San Antonio and north to the Red River, a line following the Balcones Escarpment, and from this line north and west over the Edwards Plateau (Smith, 1946).

The species appears to be uncommon in central Texas. Most of the specimens were collected on warm mornings in the spring or fall of the year except for three specimens collected on a midsummer morning after a light shower and a single specimen seen sunning itself on a warm December day. The lizards seem to prefer the rock bluff association along the streams of the Balcones Escarpment but they also occur on the rocky, cedar-covered hills above the rock bluffs. In general contrast to the western forms, as reported by Fitch, lizards of this species are characterized by slow, deliberate movements. They are seldom able to escape the collector unless they are actually in the crevices of the rock bluffs when seen. When foraging in the rocks and dry leaves at the base of the rock bluffs the lizards investigate numerous objects in their path with slow "flickerings" of the tongue. When a grasshopper or beetle is located, it is stalked slowly. The head and forebody are then elevated into an S-shaped curve. The forelimbs are often laid back against the sides of the body and the tip of the tail is twitched. The slightest movement of the prey causes a fast, snake-like strike. The prey is then crushed and turned to a suitable position for swallowing, sinuous movements of the head and neck serve to move the prey through the throat. Food habit studies were not made but captive specimens readily ate grasshoppers, crickets, June beetles, etc. and juveniles would eat the larvae of dermestid beetles. No definite indications of fighting over food was observed. Most specimens had a gentle temperament and seldom offered to bite when handled. The juveniles were more active and excitable than the adults.

The ranchers of the area call the plated lizard by several names: copperhead lizard (Strecker), Gila monster, mountain boomer or barking lizard. The two latter names indicate the common belief that these lizards emit the barking call *Eleutherodactylus latrans* (Wright & Wright). Everyone in the hill country seems to be in false agreement that the lizards are poisonous.

Copulation probably occurs only in the fall. On November 15, 1948 two captive males were observed in attempted copulation and in previous years the author has twice observed the act in the fall. The mating position is much the same as described by Fitch for *Gerrhonotus c.*

coeruleus. The male grasps the female across the temporal region of her head with his jaws, their bodies are brought into an essentially parallel position and the hind quarters are elevated at the median side of each animal to an inverted V. The tails are usually entwined. Copulation is quite slow, requiring several hours for completion. The females observed in the two cases mentioned seemed quite docile and unexcited.

On March 30, 1948, a female which had been caged all winter with males laid 14 eggs measuring, as follows: length 15.6 mm. to 18.5 mm., average 17.2 mm.; width 9.6 mm. to 10.8 mm., average 10.5 mm. For several days preceding laying, the female (head and body length 163 mm.) had been digging pits in the dirt of the cage. On May 11, 1948, a newly caught female (head and body length 163 mm.) laid 22 eggs but these were too dessicated to measure when they were found the next day. The first clutch of eggs was kept in a closed jar at room temperature. A high humidity was maintained from wet dirt in the bottom of the jar. Forty-six days later, on May 15, two of the eggs hatched. Seven more hatched on the following day, and on May 17 the remaining 3 eggs were opened with forceps. The smallest hatchling (head and body length 33 mm.) and two young with partial yolk sacs still attached were found in the three latter eggs. A longitudinal slit near one end and about one-half the length of the egg allowed the escape of the young from the eggs that hatched. The young were measured while alive as follows: head and body length 33 mm. to 40 mm., average 37.5 mm.; tail length 38 mm. to 62 mm., average 57.2 mm. Two young were preserved immediately and the rest were kept in a large dish in an attempt to raise them. They were fed grass sweepings and several were seen to eat very small grasshoppers. The young moved faster than the adults and were more excitable, their attack on prey was a simple rush and grab. None of the young lived more than a month.

The color differences of the adults and young are striking. The dorsal ground color of the adults is tan. Between the neck and the hind limb insertions are usually eight irregular cross bands or anteriorly directed chevrons of brown split and mixed with white. These bands are two to three scales in width and are separated from each other by about the same distance. Similar bands occur on the proximal two-thirds of the tail, fading out distally. Regenerated tails are a yellowish tan in color and are covered by irregular whorls of small scales. The mid-ventral surface is predominantly white but becomes increasingly mottled with gray laterally. Faint longitudinal rows of gray spots are present on the venter of some specimens. The scales of the throat are white or slightly marked with gray. The white of the dorsal bands is barely discernible on the lateral three or four rows of belly scales.

The dorsal color of the newly hatched young is black except for the head, which is tan. The cross bands are shown by the white scales only and are easily seen to the tip of the tail as well as on the lateral edges of the belly. Schmidt and Smith have noted that the black bands of the juvenile develop into the ground color of the adult. The anterior and

posterior edges of the black juvenile bands lose less color than the median portion and thus produce the light-centered, brown-edged bands on the tan ground color in the adult. The ventral color is light gray. Small black flecks form irregular cross lines or posteriorly directed chevrons on the chin and neck and other flecks form six rather distinct longitudinal lines on the belly. The supra-labials are light gray and this color is separated from the tan on top of the head by a dark band which begins at the nares and passes through the eye and widens on the temporals.

Two wild caught juveniles (head and body lengths 79 mm. and 67 mm.) show typical adult coloration except that the dark ocular stripes are faintly visible and the ventral flecks are irregularly scattered and mixed with mottlings of gray. In a juvenile (head and body length 55 mm.) from Bandera County the cross bands are lighter colored than the gray ground color and are edged posteriorly by black flecks.

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DEPARTMENT OF ZOOLOGY, UNIVERSITY OF TEXAS, AUSTIN, TEXAS

Reproduction of Captive Texas and Mexican Lizards

By JOHN E. WERLER

The following observations on the breeding and feeding habits of *Gerrhonotus liocephalus infernalis, Eumeces l. lynxe* and *Sceloporus m. mucronatus,* although incomplete, seem worthy of record in view of the paucity of existing information on their life histories. The following notes are based upon specimens which, at the time, were living in the collection of the San Antonio Zoological Society where they were under almost daily observation. The specimens of *Eumeces l. lynxe* and *Sceloporus m. mucronatus* were secured in November, 1948 during a collecting trip to southern Veracruz, Mexico and were returned alive to the San Antonio Zoo for exhibition and further observation.

Gerrhonotus liocephalus infernalis

The natural history of this form has received little attention from collectors and vivarium keepers and there seems to be no published

information to indicate whether its method of reproduction is oviparity or ovoviviparity.

A large female of this subspecies, measuring 298 mm. in total length and with a snout to vent measurement of 121 mm. was taken in Bexar County, nine miles north of San Antonio, Texas, Feb. 28, 1949. The lizard, apparently gravid when received, was isolated in a wooden exhibition cage containing an inch and a half deep layer of sand and a branching tree limb.

She became most active at night, spending much time crawling about the floor of the cage and frequently digging into the sand with her forefeet. During the day she occasionally perched on a branch of the tree limb but more often remained coiled in a corner of the cage. Mealworm larvae and beetles *(Tenebrio)* were readily eaten and formed the largest part of the lizard's diet. As many as thirty-one beetles and larvae were consumed at one feeding. Other items of food which were accepted without hesitation include house flies, ants, grasshoppers, crickets, darkling beetles, owlet moths and a new-born mouse.

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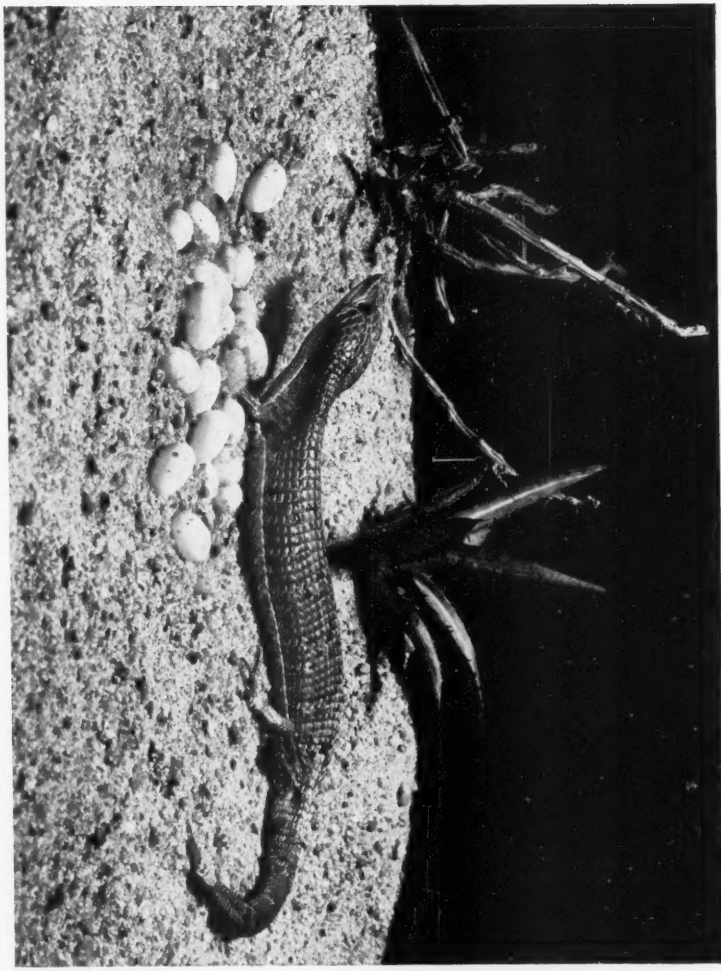
On the morning of March 21, 1949, ten eggs were found on the sandy cage floor and subsequently, during the same day, fourteen additional eggs were laid. All were symmetrically oval and non-adhesive with tough, smooth shells. Several of the eggs, which apparently were not fully developed, possessed soft, buff-colored shells. These were the smallest of the clutch.

The position assumed by the female during egg-laying was peculiar. With the passing of each egg from the cloaca, the tail was arched upward from its base and the hind legs were extended backwards and raised off the floor to a position ten to twenty degrees above the horizontal. In addition, the soles of the feet were turned upward, bringing the femur and tibia of each leg to a position where they were perpendicular to one another. A peristaltic movement of the body was sometimes employed during passage of the eggs, apparently to assist their expulsion.

The tail, which prior to laying was round and well formed, appeared shrunken the day after deposition of the eggs and there was a crook in the end of the tail where before there was none. This parallels Fitch's observations upon certain Pacific Coast *Gerrhonotus* (Fitch, 1935, Trans. Acad. Sci. St. Louis, vol. 29, no. 1, p. 7).

The length and width egg measurements, recorded in millimeters, are as follows: 18x9, 18x10, 18x10, 18x11, 19x10, 19x10, 19x11, 19x11, 20x10, 20x11, 21x10, 21x11, 21x11, 21x12, 21x12, 22x10, 22x10, 22x11, 22x11, 22x12, 23x10, 23x11, 23x13, 24x13.

The eggs were placed in a Pyrex dish beneath an inch of damp sand and here they were kept at prevailing room temperatures (75-90) for the duration of their incubation. Examination of the incubation dish on April 23 revealed seven newly-hatched lizards crawling about the bottom of the container. They were similar to the adult in coloration but possessed more striking markings. The dish was not returned to its original resting



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Gerrhonotus liocephalus infernalis from 9 miles north of San Antonio, Bexar County, Texas with part of her recently laid eggs. Total clutch numbered 24 eggs.

place on a shelf but placed on a desk where the young might be viewed more readily. The remaining eggs failed to hatch.

Total lengths of the hatchlings, in millimeters, are as follows: 43, 45, 48, 50, 51, 52.

Eumeces l. lynxe

There appear to be no published observations on the birth of this form to verify the presumption that it is ovoviviparous, although records of preserved females containing embryos almost ready to be born have been reported (Hartweg, 1931, Copeia, p. 61) and (Taylor, 1935, Kans. Univ. Sci. Bull., vol. 23, p. 171).

A female of this subspecies was collected from within a damp, rotting log on a pine forest slope, five miles south of Teziutlan in the Mexican state of Veracruz, November 17, 1948. Elevation of this site was about 7500 feet. The lizard was subsequently placed in a cage by herself when it appeared she was gravid.

On the morning of January 15, 1949, a single new-born lizard was found in the cage containing the female. It had partially buried itself in the loose sand. In coloration it was similar to the adult although much more vividly striped and possessing a striking azure-blue tail. The dorso-lateral light lines and the median light line which bifurcates on the frontal are unbroken and prominent in the new-born lizard while in the adult they are indistinct.

Although kept under close observation for more than a week following the birth, no additional young were born. It should be pointed out that there was no opportunity for any unobserved young to escape from the container; it was escape-proof.

Sceloporus m. mucronatus

Apparently the only information regarding the method of reproduction and the number of young in this form is that of Smith (1936, Univ. Kans. Sci. Bull., vol. 24, no. 21, p. 588). He states, "UMMZ 65270 contains five well-developed young, removed from the oviducts."

Among eleven lizards of this subspecies taken in an area of volcanic lava rock near Las Vegas, Veracruz, was an apparently gravid female with a snout to vent measurement of 61 mm. She was isolated from the rest and kept in a large cage containing sand and a tree limb. This female gave birth to nine young during the night of January 6, 1949. The total length and tail length measurements of the young, in millimeters, follow: 52-27, 53-28, 55-29, 58-29, 60-29, 60-30, 61-31, 62-30, 62-31.

The ground color of the young is but little darker than that of the adult. The four or five large dorsal blotches present in the adults are indistinct or entirely lacking in the new-born. The nuchal collar is less evident than in the adults. The narrow, light bands of the limbs and tail which are barely discernible in the adult are outstanding in the young. In the new-born lizards, the two parallel dark lines which extend down the middle of the throat and the lines radiating from them are pronounced while the ventral surfaces of the limbs and tail are immaculate.

SAN ANTONIO ZOOLOGICAL SOCIETY

Effect of DDT Powder on Small Cottonmouths

By D. F. MUNRO

Two two-months-old Cottonmouths *(Agkistrodon piscivorus leucostoma)* were found to be infested with mites; an attempt to exterminate the pest had an unwished-for result.

A commercial 10% DDT powder was dusted sparingly on the snakelets and in the corners of their small cages. They were left overnight without water-dishes, to eliminate the possibility of their drinking contaminated water.

Next day the two little snakes, especially the smaller of them, behaved in an alarming fashion. Upon the least stimulation (jarring the table, touch, flash of light) they whipped their heads from side to side, twitched and jerked their bodies convulsively, writhed their tails, and in general gave the impression of painful sensitivity. There was a good deal of yawning and gaping, and extreme extending of the tongue.

Obviously the DDT or other ingredient (piperonyl cyclohexenone .625%, pyrethrins .05%), whether by being inhaled or through contact, had had a harmful effect on the snakelings' nervous systems in an exposure of some 20 hours. The victims were removed from their quarters, washed carefully, put into clean cages, and supplied with frequent changes of fresh water.

For two or three days the erratic behavior was very pronounced; then the hyper-sensitivity began to diminish. A week or so later the little Cottonmouths appeared to be getting back nearly to normal, except for attacks of jumpiness in the morning when the light was turned on. This later stage of excitability was more severe in the larger individual, perhaps, as was thought, because it was getting ready to shed.

Eleven days after application of the powder, the larger of the snakelings died.

It is not certain that the insecticide was immediately responsible for this result, since the Cottonmouth was an unhealthy specimen: early in life it had developed several pus-filled "blisters" similar to those often found on newly captured snakes of all ages. (Such blisters ordinarily disappear upon the first shedding in captivity, and usually do not recur). Treatment, directed particularly to a blister on the right upper lip, below the eye, first with permanganate solution, which had seemed to be useful on Garter and Bull Snakes, then with sulfathiazole ointment, did no more than slow its progress toward the eye. The eye-scale became protuberant and filled with a white opaque substance, so that the pupil was invisible. The snakelet often rubbed the protruding scale against surrounding objects, as if to remove it.

On the day it died, this larger Cottonmouth had been thrusting and twisting its head into narrow openings under stones, apparently trying to start shedding—or perhaps in its death throes. Very shortly after death, the skin of the head was easily peeled back and the right eye was examined. Upon removal, the old ocular left the eye covered with a layer

of tough sticky substance which could be scraped off like half-dried shellac, the eye itself seeming to be unaffected; the blisters on the body were found to contain lumps of matter of similar but thicker consistency.

In contrast to its fellow, the smaller Cottonmouth had cast an unblemished slough three weeks before the powder was used. Consequently, its new skin may have been more permeable to the poison (if entrance to the system was made this way) than the "double" skin of the larger specimen, which was about to shed. This would account for the initially much greater severity of the small one's symptoms and for their delayed appearance in the other.

The small snake displayed diminishing sensitivity for three weeks and seemed to be on the road to recovery. Though it, like the other, had never fed, it was excreting frequently, as if voiding poison. But then it suddenly began to show violent symptoms again: spasms of extreme jumpiness, much apparently painful gaping, and almost continual tail-writhing. At times it seemed to breathe with difficulty; a small amount of blood was visible in the back of its mouth when it yawned; tongue movement was generally feeble.

After three days of these attacks the snakeling died.

This individual had developed one small blister, on its upper left lip. Sulfa appeared to check the blister for a month, but during the last week or so, the infection invaded the left eye, causing swelling and opacity. This indicated, perhaps, a breakdown in its health and resistance resulting in a recrudescence of convulsive behavior. Both young snakes may have been more susceptible than feeding specimens would be.

This experience shows that DDT, though it apparently killed the mites, is too hazardous to use for this purpose.

MANHATTAN, KANSAS

Eating Habits of Young *Coluber constrictor flaviventris*

By D. F. MUNRO

Two young Blue Racers which hatched in captivity on August 23 and 24, 1948, showed in early life some interesting deviations from the customary eating procedures of grown specimens.

As is well known, Blue Racers, though not constrictors, do pin down with a loop of the body any prey which is large and active enough to cause inconvenience in swallowing. After the initial capture, especially vigorous victims are sometimes held firmly in this manner for several minutes until relative quiescence ensues, before the snake makes any effort to swallow them.

The two infant Blue Racers in question began eating about two weeks after hatching. It was not always convenient or even possible to procure frogs so small as to offer little resistance to the snakelets, with the result

that most of the time they were forced to cope with prey which taxed their ability nearly to the utmost.

It was noted, particularly in just these instances of relatively large and recalcitrant victims which caused the snakelings a great deal of trouble, that the little Blue Racers did not pin down the prey, nor did they appear to make any attempt to do so. Every effort was directed solely to a "brute strength" process of engulfment by jaw-work alone. Swallowing was continuous from the moment of capture; there was no waiting for the frog to weaken. True, the snakelets sometimes restricted the frog's struggles by pushing it against the side of the cage or other object, and occasionally against their own bodies, but this seemed an accidental rather than a purposeful act, and certainly was not consistently resorted to.

It is almost invariably observed that, when swallowing a relatively large frog which has been seized by a hind leg, grown snakes of various species, including Racers, work their jaws up that leg and then get control of the other, usually partially releasing the first leg so as to be able to swallow both together, in this way making easy the deglutition of the animal with a minimum of struggling and resistance on its part.

But here again, the young Blue Racers differed in their procedure. After catching a frog by a rear leg (the most frequent manner of capture), they would work up that leg, then go straight on up the body, disregarding the other leg entirely. This free leg now had to be pressed along the side of the frog's body, and consequently occasioned the snakelings no little difficulty, for two reasons: first, because with this leg still free, the frog was able to offer much greater resistance, and second, because the body and leg together made a considerably bulkier object for the snake to get down its throat.

Feeding of the small snakes was discontinued for the season on October 17. Up to this time, besides other food, one Blue Racer had consumed 12 frogs, the other, 9, and neither had shown any evidence of improvement in eating technique.

The two points of seeming awkwardness in the eating habits of the baby Blue Racers during their first season suggest that the more commodious methods of overcoming a refractory frog may be a learned skill; the implication is that snakes learn slowly. However, an alternative explanation could be that certain reflexes enabling the snake to cope with troublesome victims more efficiently are not developed at this early stage in the snake's life; this indicates in turn that a snake learns little by individual experience, and, more specifically, that infant Blue Racers in nature do not normally feed on frogs, and hence "just don't know what to do" when they catch one too soon.

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Excreta of a Blue Racer with Reference to Diet

By D. F. MUNRO

Study of the activities of a small adult female *Coluber constrictor flaviventris* caught on June 23, 1948, gave rise to the following observations:

Cursory examination of the feces eliminated before feeding in captivity showed that the snake had eaten a large number of good-sized grasshoppers and possibly other insects in the last day or so before capture. The undigested integuments of the insects floated on the surface of a pail of water when the excreta were rinsed from the cage, the characteristic thigh joints being especially conspicuous.

Similarly, a four-foot male Blue Racer, caught on June 24 and released a few days later, likewise excreted a very large mass of insect remains, which were readily distinguishable when dumped into water.

The small female was periodically fed chopped horsemeat and strips of beef, but no natural food. As a result, her excrement soon became of a consistency quite different from "normal," that is to say, it was made up of a clear, pale-yellow liquid, the usual white granular substance, and gelatinous, rounded lumps of a light brownish-yellow color. There was no more of the pasty black matter which is ordinarily a part of the feces. This change in the nature of the excreta had been noticed also in other snakes fed a steady diet of meat.

It had been observed further that if a snake were fed even a single frog, mouse, or bird after a regimen of meat, the black ingredient would be present in the first elimination clearly resulting from that natural food. No doubt the black substance represents, in the main, waste products or indigestible parts of the food; meat appears to contain little material not directly assimilable.

On July 20 the snake shed her skin and swallowed it. The latter act was probably a result of nervousness, not of hunger, because she had been fed small quantities of meat several times in the preceding two weeks. The nature of the snake's feces resulting from the meat diet having been noted, it was with considerable interest that indications were awaited regarding the ultimate fate of the ingested slough.

The snake had been last fed two or three days before shedding; she was fed again a few hours after shedding and swallowing her skin, and on July 22. On July 21 the typical meat-diet excrement was voided; on July 24 the excreta contained a quantity of soft black matter of no discernible structure; on July 26, and later, the characteristic meat-diet feces was again in evidence.

It seems fairly safe to conclude, therefore, that the skin was completely disintegrated, but not assimilated, upon passage through the digestive tract, being treated like the waste portions of natural food.

Such observations suggest that a good deal can be learned about the diet and digestive processes of snakes in a humanitarian way without the necessity of killing them for study of the stomach contents; the reptiles can thus later be released, to resume their part in maintaining the balance of nature. KANSAS STATE COLLEGE, MANHATTAN, KANSAS

Additional Records for *Clemmys muhlenbergii* from Maryland

By JOHN E. COOPER

McCauley and Mansueti (1943, p. 197) secured the first definite record for *Clemmys muhlenbergii* in Maryland. This record was based on a specimen collected 1 mile north of Grave Run Mills, Baltimore County, in August, 1941 by Joseph Bures and Conrad Kenny. Previously, Brady (1937, p. 139) reported this turtle between the C. & O. Canal and the Potomac River in Montgomery County but without reference to a definite specimen. More recently two additional specimens of this rare turtle have been collected in Maryland, both of them from the floodplain of the Susquehanna River below the Conowingo Dam in Cecil County. The occurrence of *muhlenbergii* in this region was predicted by McCauley (1945, p. 157) and was to be expected since the Susquehanna River flows through identical adjacent sections of the same drainage system in southeastern Pennsylvania where the turtle is rather common. Fowler (1915) and Conant (1945, p. 8), who have collected rather extensively in the region, do not record the species from Cecil County.

The first of the new specimens (NHSM-R858) was found on April 6, 1947 burrowing into the moist humus on the edge of a small, intermittent, vegetation-choked pond. It was an old male, the carapace of which had the following dimensions: length—91mm., width—61mm., height—35mm. The pond was on the edge of a large, meadow type field, bordering a deciduous woods.

The second specimen was collected on April 27, 1947 by John E. Norman. The following field notes were made at the time of its capture. The turtle, a female, was first seen on the bank, a few inches from the water, of one of the many small ponds on the east side of the Susquehanna River just below the Conowingo Dam. It moved swiftly on land but did not seem to be able to move very fast in water when it swam about two feet from the bank and hid in leaves on the bottom in approximately twelve inches of water. At the time of its capture, just after midday, the temperature was 16° C. The measurements for this specimen were as follows: carapace length—82mm., carapace width—62mm., height—32mm.

The section of the flood plain where these turtles were collected is a sphagnaceous swamp bounded on the north by a small cattail marsh almost at the foot of the Dam, on the south by a large, meadow-type field which separates it from a wooded section along Octorora Creek, on the east by the beach of the Susquehanna River, and on the west by a culvert, approximately 25 feet wide, and a low hill which separates it from the road. The bottom of the pools and streams in this area are covered with leaves and debris. *Clemmys guttata, Chrysemys p. picta, Sternotherus o. odoratus, Cheyldra s. serpentina, Terrapene c. carolina, Clemmys insculpta, Elaphe o. obsoleta, Natrix s. sipedon, Thamnophis s. sauritus, Rana clamitans, Rana catesbeiana, Rana palustris, Hyla c. crucifer, Acris crepitans,*

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Bufo w. fowleri, Hemidactylium scutatum, Plethodon c. cinereus, and *Ambystoma maculatum* are abundant in the region. *Coluber c. constrictor* has also been observed, as well as a larval *Pseudotriton r. ruber* and two adult female *Triturus v. viridescens.*

Subsequent field trips to the Conowingo region during the spring and early summer months have revealed no further specimens of *muhlenbergii* with the exception of a shell found by Romeo Mansueti and identified as this species. However, Muhlenberg's turtle has apparently established itself in Cecil County, an assumption, the veracity of which would be enhanced, by the discovery of young specimens or eggs. Its occurrence in adjacent Harford County should also be anticipated.

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Handbook of Frogs and Toads

By ALBERT HAZEN and ANNA ALLEN WRIGHT

Handbooks of American Natural History, 3rd edition. Ithaca, N. Y.: Comstock Publishing Company, Inc., 1949; vi-xii, 1-640, figs. 1-7, pls. 1-CXXVI, maps 1-37. $6.50.

The new frog book has been anxiously awaited by both herpetologists and nature lovers. The former group will undoubtedly be disappointed with the outdated taxonomy, the latter delighted with the completeness of the descriptions, and both with the new section on biology and the incorporation of keys to egg and larval stages. This book will be indispensable to amateur and professional herpetologists, and other students of natural history as well, and will stimulate, or perhaps precipitate, studies of at least some of the groups of anurans. It is unique by inclusion of both immature and adult stages of all the species of the United States and Canada.

The beginning general account includes explanations of the topic headings and a well written section on the biology of the anura. The latter has been considerably augmented over the 1933 edition by inclusion of new topics, such as geologic speculation; maps of biomes and rainfall; discussion, plates, and keys for the identification of the eggs and larval stages; and a more complete treatment of structure, secondary sexual characters, development, and transformation.

The next section contains keys to families and to species and subspecies. The keys of this book are a decided improvement over those of previous editions inasmuch as subspecies may be determined in the keys rather than by consulting plates and descriptions. The attempts of this reviewer to key out certain difficult forms have ended in failure, however, due to the frequent contradictions encountered.

A new and extremely valuable feature of this edition is the attempt of the authors to describe most of the species from living animals. The plates are, on the whole, good although in a few cases some clarity has been lost with reproduction. The photographs of different aspects of the living animals are especially useful. In only a few cases are localities given for specimens figured, and these call attention to the desirability of including such information for every plate. The maps are well done and, although the range-shading of certain ones is somewhat bizarre, the plotting of distribution of each species is a very acceptable feature of the new book. The arrangement of topics under each species (range, habitat, size, general appearance, color, structure, voice, breeding) is convenient and usable. In several cases original descriptions are quoted or topotypes are described. The inclusion of "Journal Notes" and the "Authorities' Corner" will, no doubt, be of interest to readers in general but of little value to herpetologists. There may be some doubt as to whether this space might not have been used more profitably with a brief synonomy, short summary of variation, or a more complete diagnosis.

Wright and Wright's departure from present nomenclature is so frequent that each case cannot be discussed. In many cases the authors indi-

cated that they were aware of these changes and in several instances they state approval, but they have, nevertheless, retained many old names and old combinations. It is unfortunate that so much space has been used in treating such established synonyms as *Pseudacris occidentalis, Hyla avivoca, Microhyla areolata,* and the genetic variants of *Rana pipiens.* On the other hand, *Acris gryllus dorsalis, Hyla versicolor sandersi,* and the races of *Bufo compactilis* are either barely mentioned or omitted entirely. In frequent cases forms have been assigned to new rank without clarification. Notable among these is the reduction to subspecific status of *Pseudacris clarkii, Hyla phaeocrypta,* and all the spadefoot toads except *couchii.* The treatment of *Hyla phaeocrypta* is especially disconcerting. *Microhyla carolinensis* and, unaccountably, *Bufo terrestris* are retained as monotypic species. Other changes, as the retention of *ocularis* as a species of *Pseudacris,* may express the Wrights' own opinions.

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The bibliography is divided into general works, general check-lists and catalogues, and state and province lists. The last named feature is extremely useful. The bibliography is chronological rather than alphabetical; this system may have its merits. The absence of titles from the references, however, is disappointing and renders many of the citations meaningless. Mechanically, this handbook is excellent, and printing errors are remarkably rare.—Philip W. Smith, *Urbana, Ill.*

* * * *

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Food Habits of the Brown Skink, *Leiolopisma laterale* Say

By JAMES A. SLATER

This paper presents an analysis of the stomach contents of eighty-four adult specimens of *Leiolopisma laterale* Say, collected in Louisiana during 1946 and while the writer served as research assistant on the Tulane University Herpetological Expedition of 1947. The lizard specimens are deposited in the herpetological collection of Tulane University.

Very little has been reported of the food habits of these small lizards. Moore (1896) reports a captive specimen feeding upon "*Julus, Polydesmus* and pillbugs (Armadillo), besides small beetles and flies, a larval grasshopper and an earthworm (Allurus)." Ditmars (1907) (1936) mentions this lizard feeding upon ants, ant larvae and grubs of small wood boring beetles. Strecker (1927) notes *L. laterale* as "partial to smal larvae." McCauley (1939) reports a cricket and a small moth from the stomach of a single specimen taken in Maryland. Carr (1940) notes it as "active in hunting leaf mold insects," and thinks autophagy may take place. Brimley (1941) reports specimens feeding upon flies in captivity. Cook (1942) states that their food consists entirely of insects. Smith (1946) mentions the skink feeding upon "small insects, larvae and adults alike . . . millipedes, pillbugs, beetles, and earthworms are eaten." He further notes that spiders should form a considerable part of the diet, but that they have not been recorded. This observation is of considerable interest in view of the results obtained in this study.

The brown skink appears to be primarily crepuscular in its feeding activity. However, they probably feed to some extent during the daylight hours. In almost three months of nightly collecting we failed to take a single individual at night other than under cover and in a quiescent condition.

The food proved to consist almost exclusively of arthropod material. the only other food was a few snails *Zonitoides arboreus* Say and *Retinella indentata* Say. All five of the principal classes of anthropods were present with insects much the most abundant. In all, fourteen orders of insects were encountered in the stomachs examined.

The feeding habits of the brown skink must be considered to be basically determined by the availability of the food supply. However, in certain instances the probability of preferences and rejections seems to be indicated. The proportion of spiders taken (present in 31% of stomachs and ranking second in quantity) seems somewhat higher than might be expected and may point to a preference for this type of food by the skinks.

The relative numbers of Homoptera and Heteroptera taken are interesting. Heteroptera which constitute a large order and possess many ground inhabiting forms were found in only four stomachs and three of these records are based upon fragments of a small thread-legged Reduviid (*Ploiaria hirticornis* Banks). Homoptera, in contrast, ranked as the fifth largest quantity of food and were present in more stomachs than any other

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group aside from spiders and Coleoptera. This scarcity of Heteroptera possibly shows some rejection by the lizards and may possibly be due to scent gland secretions which many families possess.

Termites comprised a surprisingly small proportion of the food when one considers the secretive habits of the skink which should bring it into frequent contact with termite colonies. Both worker and soldier castes were taken from the stomachs.

Coleoptera comprised the largest single group of organisms taken by the lizards. While this is probably a correct indication of availability for this largest of insect orders, it is felt, that the heavy sclerotization of many beetles may tend to make the fragment discoveries somewhat higher than the true proportion. The following families were most frequently present: Chrysomelidae, Tenebrionidae, Carabidae, and Elateridae.

The Orthoptera illustrate well the comparatively large size of some of the prey taken by these small skinks. Two stomachs contained adult specimens of the mole cricket, *Gryllotalpa hexadactyla* Perty. The majority of Orthoptera consisted of nymphs and adults of wood roaches and a few camel crickets (*Ceuthophilus* sp.) also were present.

Ants comprised almost all the Hymenopterous insects taken, but several small Chalcids were also present.

Crustacea which ranked as the sixth most important food item were represented by a single species of amphipod, *Talitrus sylvaticus* Haswell.

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